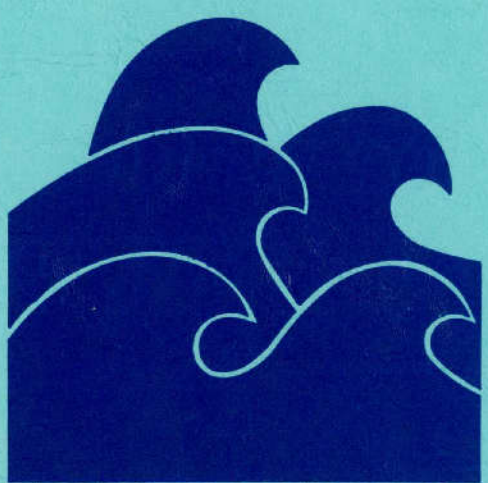
Report 247

MODERN TOPOGRAPHIC MAPPING OF TEXAS-AN HISTORICAL SKETCH



TEXAS DEPARTMENT OF WATER RESOURCES

May 1980

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REPORT 247

MODERN TOPOGRAPHIC MAPPING OF TEXAS

An Historical Sketch

By

C. R. Baskin

May 1980

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PREFACE

Before the days of acute awareness of the finiteness of our prime energy resources, automobile performance data often included a statement on how many seconds might be required for a car to accelerate from 0 to 60 miles per hour. In the realm of modern topographic mapping in Texas, we could ask how much time was required to get from 10 to 82 percent of the coverage of the State.

This report tells a bit about how this accomplishment was realized in 21 years. Published 7½-minute mapping coverage is the specific accomplishment. If the 72 percent increase in coverage over 21 years does not sound too impressive, consider that we are speaking of mapping accurately and in detail something over 215,000 square miles. That is averaging over 10,000 square miles per year in securing modern maps meeting National Map Accuracy Standards.

Some of the matters related to this achievement, which has been realized at a cost approaching $50 million, are also touched upon in this report. The report seeks to document the rate at which modern mapping coverage of Texas has proceeded up through calendar year 1978. It is hoped that the tremendous undertaking of obtaining modern mapping coverage for all of Texas will soon reach its initial completion.

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An Historical Sketch

ACKNOWLEDGEMENTS

The author is greatly indebted to G. Emil Blomquist, head of the Department's Topographic Mapping Unit, which manages the Map Distribution and Information Center, for accomplishing much of the research on which this report is based. Also, appreciation is expressed to Albert E. Letey, chief, Rocky Mountain Mapping Center, U.S. Geological Survey for his help and suggestions and the information furnished by his staff for inclusion in this report.

An expression of gratitude to Mr. Letey and his predecessors for the remarkable progress of the topographic mapping program is in order. These predecessors include Thomas V. Cummins and the late Roland H. Moore.

STATUTORY CHARGE

With the passage of the Water Planning Act of 1957, the State of Texas accepted responsibility for having a part in effectuating modern topographic mapping of the State. This responsibility was made a direct part of water-planning legislation because of the recognition by the First Called Session of the 55th Legislature of the integral relationship of topographic-mapping coverage to water-resource planning and development. The legislation established the position of Chief Topographic Engineer of the Texas Board of Water Engineers to initiate and administer a cooperative topographic mapping program for which the Legislature provided funding. Currently, the statutory directive to the Department of Water Resources to carry out a program for topographic mapping of the State is found in Section 16.017 of the Texas Water Code.

BACKGROUND

As used in this report, the term "modern mapping" applies to U.S. Geological Survey 7½-minute quadrangle mapping which meets National Map Accuracy Standards. Modern 7½-minute mapping of Texas commenced in 1947 as a part of the National Mapping Program of the U.S. Geological Survey. With the Water Planning Act of 1957 becoming effective December 2, 1957, the State of Texas embarked on a modern topographic mapping program in cooperation with the U.S. Geological Survey by means of a signed agreement.

The National Map Accuracy Standards were adopted in 1941, following their evolvement by federal map-using and map-making agencies in a series of conferences sponsored by the then Bureau of the Budget. The 1941 Map Accuracy Standards were formally implemented by the U.S. Geological Survey through Survey Order 160 in 1947. This Survey Order was later incorporated into the U.S. Geological Survey Topographic Instructions (procedural manual) as "Accuracy Specifications for Topographic Maps," dated October 1952, and subsequently amended in 1954 and 1957. All maps published by the U.S. Geological Survey and meeting National Map Accuracy Standards carry an accuracy statement in the lower margin. For the benefit of the technically inclined reader, a copy of the National Map Accuracy Standards is included as Appendix A to this report.

The 7½-minute series maps being produced in Texas by the U.S. Geological Survey are at a scale of 1:24,000 and cover 7½-minutes of latitude and 7½-minutes of longitude. It has been determined that 4,376 of the 7½-minute quadrangle maps will be required to completely cover the area of the State. At the time the State of Texas commenced cooperative participation in the modern mapping program, only 440 quadrangles, covering about 10 percent of the State's area, were available in published form.

USES OF MODERN MAPS

Topographic maps are recognized by planners, developers, and builders as being indispensable tools in our

modern society. As our concerns grow greater in the area of inventorying, developing, and managing and conserving our natural resources while preserving the environment and accommodating the necessary advancement of our society, we must avail ourselves of every possible mechanism to address these vital needs. Topographic maps constitute one of the most reliable and useful tools for use in meeting these needs.

Whether it be for the study and application of flood control, soil and water conservation, energy and mineral resource exploration and development activities, land resource planning endeavors, or just the selection of prime fishing sites and good locations for hunting and camping, modern topographic maps have many and varied uses. It has been truly said that all of the outdoors can be better understood and appreciated with the aid of topographic maps.

EARLY COOPERATIVE MAPPING

The first cooperative mapping program participated in by the State of Texas was initiated in 1902 and involved The University of Texas at Austin and the U.S. Geological Survey. The purpose of the program was to map areas in West Texas in relation to mineral exploration and development. Three maps were produced under The University of Texas and U.S. Geological Survey Coop program and covered portions of Pecos, Hudspeth, Culberson, and Brewster Counties. One quadrangle, named "Terlingua District," covering a portion of Brewster County, was mapped to a scale of 1:50,000 with a 25-foot contour interval; the other two quadrangles were mapped to a scale of 1:125,000 with a 50-foot contour interval.

In 1909 the then State Levee and Drainage Board (later known as the State Reclamation Department) signed an agreement with the U.S. Geological Survey to do cooperative mapping in Texas. This agreement resulted in the completion of six topographic maps (scale 1:24,000) covering portions of Collin, Rockwall, Dallas, Kaufman, Milam, Washington, Waller, Grimes, and Burleson Counties. State funding for this 2-year joint mapping effort was $18,417.

The State Reclamation Department initiated a limited cooperative agreement with the U.S. Geological Survey in 1916 to map additional lowland areas and State Prison System properties. Several agreements were made between the State Reclamation Department and U.S. Geological Survey extending up until about 1934. A few of the maps produced under the State Reclamation Department and U.S. Geological Survey mapping effort were at a scale of 1:24,000.

Due to very limited funding capabilities, most of the State Reclamation Department mapping during this time covered small specific areas of interest rather than quadrangles defined by geographic coordinates. For example, the overflow valleys were very irregular and often not 8 miles wide, thus mapping under the U.S. Geological Survey quadrangular system would have necessitated expensive surveying and mapping of surrounding areas not of prime interest. These limited-area maps were produced at scales of 1:12,000 and 1:6,000.

During the State Reclamation Department and U.S. Geological Survey limited Cooperative Mapping Program of 1918-34, some other U.S. Geological Survey cooperative mapping was accomplished in Texas with funding help from local cooperators and the U.S. Army Corps of Engineers. Four 15-minute series quadrangles (scale 1:62,500) covering portions of Pecos and Brewster Counties were produced in 1920-21 under a second cooperative agreement between The University of Texas and the U.S. Geological Survey.

In September 1923, the Texas Board of Water Engineers (a predecessor agency of the Texas Department of Water Resources) signed a 2-year cooperative agreement with the U.S. Geological Survey to map potential reservoir sites in Texas. Like the State Reclamation Department cooperative agreement, the Board of Water Engineers mapping program was primarily directed toward specific potential reservoir sites and was not concerned with the quadrangular system of the U.S. Geological Survey. Although the Survey mapped the potential reservoir sites in Texas on a 15-minute series quadrangle format, the areas outside of the actual sites were not mapped. Therefore, blank spaces existed on the 15-minute maps published under the Board of Water Engineers and U.S. Geological Survey cooperative agreement. This cooperative mapping program involved a pioneering application of aerial photography for compiling topographic maps.

CURRENT COOPERATIVE PROGRAM

The matching funds cooperative mapping program commenced under the Water Planning Act of 1957 enabled the State to obtain urgently required coverage for water-planning purposes in specific areas. Other mapping, all-federally-funded under the Survey, Investigation Research (SIR) Program, continued to take place in Texas after the initiation of the cooperative mapping program in fiscal year 1958. It was realized that if the two programs could be coordinated and if the map users of the State could influence decisions on where the all-federally-funded mapping would be undertaken,

desired coverage of the State could be achieved much more systematically.

Participation by the State in a cooperative program did not result in any direct commitment for more extensive mapping as a part of the all-federally-funded program. However, it seemed logical to assume that State funding of mapping would likely be convincing evidence of interest in and need for maps. It was hoped that the State funding would become "seed money" to encourage a more extensive all-federally-funded program.

It seems to have worked in that fashion. Of the 3,605 published 7½-minute quadrangles available by the end of 1978, a total of 2,546 were produced under the all-federally-funded program, 1,006 under the State-federal cooperative program, and 53 under State-local-federal or local-federal cooperative programs. This is to say that over 70 percent of our currently available published 7½-minute maps are products of the all-federally-funded (SIR) program. Figure 1 reflects the status of topographic mapping in Texas as of December 31, 1978.

Since State Fiscal Year 1958, a total of $6,736,850 in State funds has gone into the cooperative mapping program. Over these years State funding has ranged from a minimum of $167,155 in 1958 to a maximum of $518,000 in 1971.

Figure 2 charts State funding of the modern cooperative topographic mapping program by State fiscal years, commencing with 1958. (The State fiscal year extends from September 1 to August 31.) Appendix B details the annual State expenditures for mapping by State fiscal years for the 21-year period 1958-78.

Total funding for the modern topographic mapping program in Texas approaches $50 million. If the cost of the pre-1958 mapping is included, the total cost figure exceeds $50 million. The U.S. Geological Survey has basically done a good job of controlling the cost of mapping. The cost of Survey topographic mapping per square mile in the area of which Texas is a part (Rocky Mountain Area) has varied from a low of $139 in 1964 to a high of $314 in 1978. Figure 3 reflects the cost fluctuations, and Appendix C details the cost figures by federal fiscal years for 1958-78. (The federal fiscal year extends from October 1 to September 30.)

THE TEXAS MAPPING ADVISORY COMMITTEE

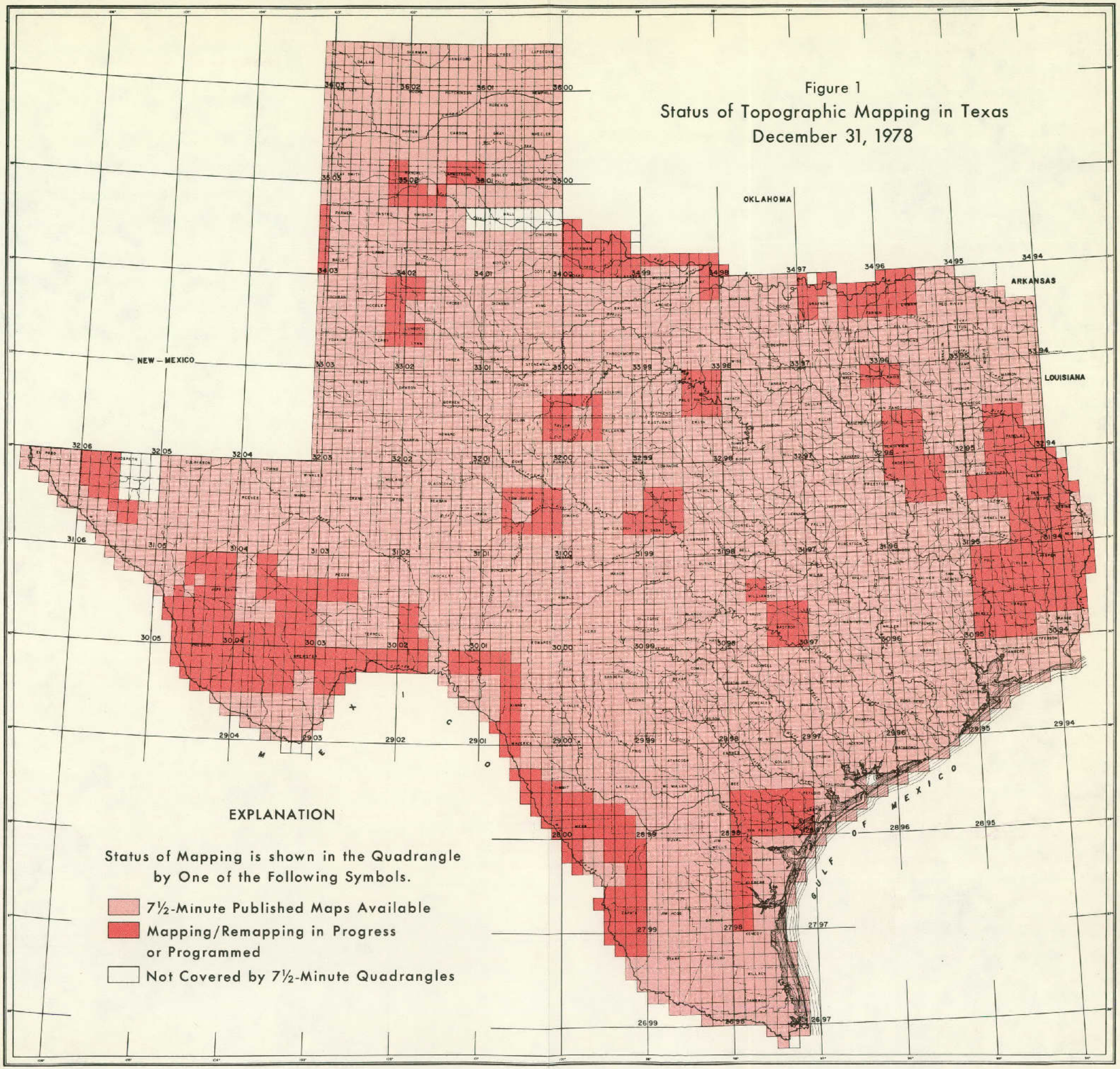
A vehicle to assemble input from map users of the State was established in 1960. The vehicle is the Texas Mapping Advisory Committee (TMAC). The organizational meeting of this committee was held on September 20, 1960. The Mapping Advisory Committee has, since its establishment, been recommending to the U.S. Geological Survey those areas of the State which the Committee felt were most urgently in need of consideration for mapping coverage under the all-federally-funded mapping program. Published mapping coverage of Texas available at the time of the establishment of the Committee in 1960 was limited to 13 percent of the State's area. Published coverage has now reached over 82 percent of the State's area.

Customarily the Mapping Advisory Committee holds an annual meeting during September. Members of the Committee include representatives of the following entities: the Texas Society of Professional Engineers, the Texas Surveyors Association, the City Planners Association of Texas, the Lower Rio Grande Valley Chamber of Commerce, the South Texas Chamber of Commerce, the East Texas Chamber of Commerce, the West Texas Chamber of Commerce, the Texas General Land Office, the State Department of Highways and Public Transportation, the Texas Parks and Wildlife Department, the Texas State Soil and Water Conservation Board, the Bureau of Economic Geology of the University of Texas at Austin, the Texas Forest Service, the Texas Department of Water Resources, and the Remote Sensing and Cartographic Committee of the Texas Natural Resources Information System Task Force. For the last 2 years, attendance at the Committee's annual meeting has been 100 percent of the membership. Also in attendance at the annual meetings are representatives of the Rocky Mountain Mapping Center of the U.S. Geological Survey in Denver, Colorado and usually a representative of the Topographic Division from the National Center of the U.S. Geological Survey in Reston, Virginia. The annual meeting affords an opportunity for all members to jointly review the status of mapping in the State of Texas. Discussions are held relating to recent advances in mapping technology as reported upon by the U.S. Geological Survey.

The Mapping Advisory Committee makes specific recommendations for areas of the State to which it collectively wishes to assign a high priority for early mapping coverage and also provides a number of general recommendations for inclusion in its advisory report to the U.S. Geological Survey. The individual priority areas for mapping selected by each member are discussed at the annual meeting. Members then have 30 days to consider, in the light of discussion at the meeting, the areas they tentatively selected originally for mapping priority emphasis and furnish the secretary of the Committee with their final specific choices for those areas which they feel should be mapped. The Committee uses a rather detailed

Figure 1

Status of Topographic Mapping in Texas
December 31, 1978



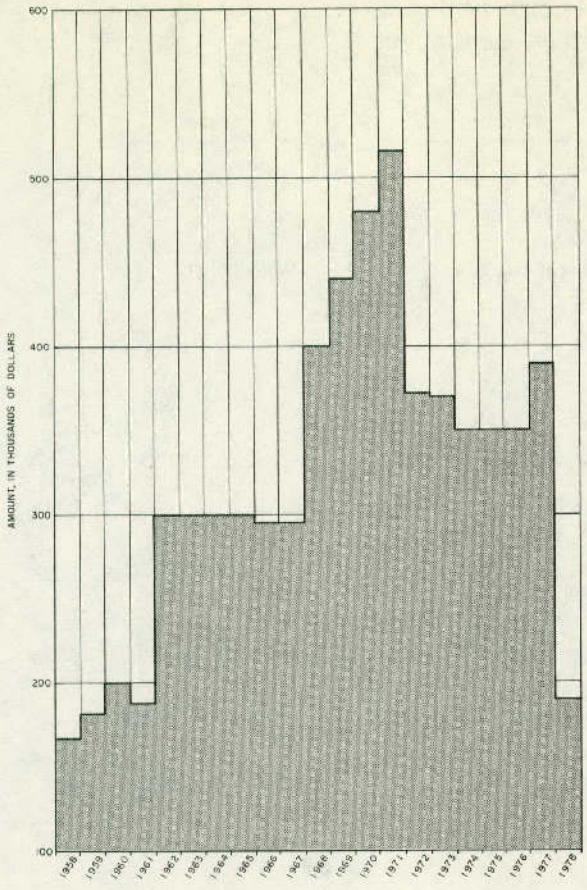


Figure 2.—Annual State Expenditures for Topographic Mapping in Texas 1958-78 State Fiscal Years

procedure to enable its individual members to reflect three levels of priority for areas to be mapped, with a specified number of quadrangle selections being permitted in each of the categories and a different weighting being given to each level of priority. Utilizing this procedure, a cumulative or aggregated committee expression of areas for priority consideration for mapping becomes available.

The Committee submits an annual report to the Topographic Division of the U.S. Geological Survey in late winter in order to ensure that the Division has ample opportunity to consider map-user views from Texas prior to the annual authorization of mapping under the all-federally-funded mapping program.

The Mapping Advisory Committee is an important means for aiding in accomplishing the statutory mandate to achieve the topographic mapping of Texas, and consequently is provided staff support by the Texas Department of Water Resources.

The reports of the Texas Mapping Advisory Committee are considered models by the Topographic Division of the U.S. Geological Survey. Others also have become aware of and recognized the thoroughness and completeness of the annual Texas Mapping Advisory Committee reports. Several other states have at times requested sufficient copies of a Texas Mapping Advisory Committee Report to furnish to their entire mapping advisory committee.

Since its establishment in 1960, the Texas Mapping Advisory Committee has held 22 meetings. Four meetings were held before the submission of the Committee's First Report in March 1961. Three additional meetings preceeded issuance of the Second Texas Mapping Advisory Committee Report. Although no meeting was held in 1966, the Committee's mapping priority requests were included in and submitted to the U.S. Geological Survey by means of the then Texas Water Development Board Report 40, January 1967. A chronology of meetings and reports of the Texas Mapping Advisory Committee follows:

Chronology of Meetings and Reports of the Texas Mapping Advisory Committee

Meeting	Date	Report	Date
1st	September 20, 1960 Organization meeting	—	—
2nd	November 28, 1960	—	—

Chronology of Meetings and Reports of the Texas Mapping Advisory Committee—Continued

Meeting	Date	Report	Date
3rd	January 25, 1961	–	–
4th	March 1, 1961	First Report	March 1961
5th	September 22, 1961	–	–
6th	December 13, 1961	–	–
7th	October 19, 1962	Second Report	January 1963
8th	November 8, 1963	Third Report	January 1964
9th	October 16, 1964	Fourth Report	January 1965
10th	November 5, 1965	Fifth Report	January 1966
	No meeting in 1966	Report 40	February 1967
11th	November 10, 1967	Sixth Report	January 1968
12th	November 18, 1968	Seventh Report	February 1969
13th	November 10, 1969	Eighth Report	January 1970
14th	October 6, 1970	Ninth Report	January 1971
15th	September 27, 1971	Tenth Report	January 1972
16th	September 25, 1972	Eleventh Report	February 1973
17th	September 24, 1973	Twelfth Report	February 1974
18th	September 30, 1974	Thirteenth Report	February 1975
19th	September 29, 1975	Fourteenth Report	February 1976
20th	September 27, 1976	Fifteenth Report	January 1977
21st	September 26, 1977	Sixteenth Report	January 1978
22nd	October 2, 1978	Seventeenth Report	February 1979

Over 6,400 mapping priority requests have been submitted to the U.S. Geological Survey by the Texas Mapping Advisory Committee. These requests, made in 18 reports, applied to 2,320 separate 7½-minute quadrangles. Taking into account that the number of priority requests submitted by individual committee members has likely averaged at least 8 to 10 times the number of aggregated committee priority requests, the Committee Secretary has probably analyzed well over 50,000 separate priority requests since the Texas Mapping Advisory Committee was established.

TEXAS CODE INDEX SYSTEM

As the intensification of mapping activity took place beginning in fiscal year 1958, a system for filing,

storing, and retrieving these maps became an important consideration. The Chief Topographic Engineer of the Texas Board of Water Engineers at that time, the late H. A. Beckwith, devised the Texas Code Index System for addressing this extremely important subject. The Texas Code Index is a numerical filing system utilizing the latitude and longitude of the southeast corner of topographic maps for identification purposes. Physical filing arrangements for maps indexed in this fashion are much simpler than those for filing maps alphabetically. No means are available to accurately anticipate the names which will be given to various quadrangles as they are mapped and to provide ample filing space for the maps. With a total of 4,376 quadrangles to ultimately store and file, systematic physical filing arrangements are absolutely mandatory. By its very nature the Code Index enables anticipation of required filing spaces. Additionally, filing maps for an area the size of the State of Texas in an alphabetical fashion would present the serious disadvantage of not having a group of maps covering a specific area filed in the convenient fashion for ready assembly.

The Texas Code Index Number is assigned by utilizing the whole-degree designation of first the latitude and then the longitude of the southeast corner of the 1-degree area in which any map may lie. The 1-degree quadrangle is then sectioned into four 30-minute quadrangles that are numbered in a clockwise fashion, from 1 to 4, beginning with the southeast quadrant. The 30-minute quadrangles are then quartered to form four 15-minute quadrangles which are likewise numbered in a clockwise fashion, beginning in the southeast quadrant. Lastly, the 15-minute quadrangles are then divided into 7½-minute quadrangles, designated in the same clockwise fashion beginning with number 1 for the southeast quadrangle. A 1-degree quadrangle is thus subdivided into 64 parts which are easily and quickly identified by assigning the numbers as prescribed.

For areas in Texas which lie in 1-degree quadrangles west of the 100th meridian, only the last two digits of the whole-degree meridian designation are used in the Texas Code Index Number. Thus, for the 1-degree quadrangle whose southeast corner lies at latitude 31°00'00" and longitude 101°00'00", the first four digits of the Code Number would be 3101. After recording the latitude and longitude coordinates as the first four digits of a Code Index Number, a hyphen is next set down, and the number designating the 30-minute, 15-minute, and 7½-minute quadrangle in which a particular map is located is then shown. For maps covering a 15-minute quadrangle, a 0 (zero) is assigned to the last digit (representing the 7½-minute quadrangle designation). Likewise, if a map covers a 30-minute quadrangle, two 0's (zeros) are assigned (one each for the 15-minute and 7½-minute quadrangles thereby identified).

Reference to Figure 4 and a careful reading of this explanation will enable the reader to understand and use the Texas Code Index Number for any standard topographic map in Texas.

In July 1977, the U.S. Geological Survey began imprinting the Texas Code Index Number on all newly published or republished 7½-minute topographic maps of Texas. Prior to the initiation of this procedure, each quadrangle sheet received by the Map Distribution and Information Center was hand stamped with the appropriate number before being filed. As a result of the

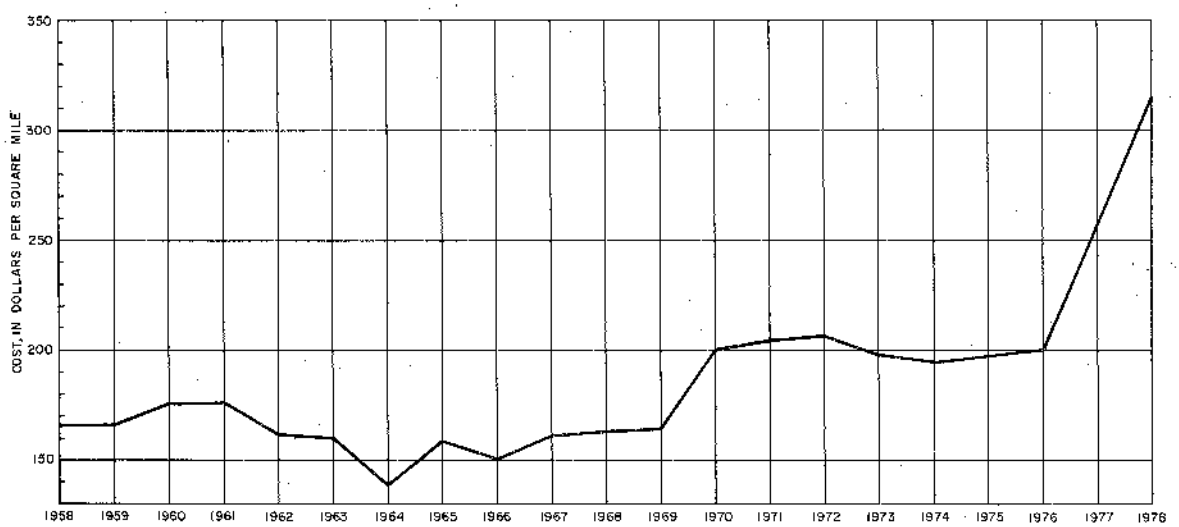


Figure 3.—Cost of Modern Topographic Mapping in Dollars per square mile for U.S. Geological Survey—Produced Maps in the Rocky Mountain Area, 1958-68 Fiscal Years (Federal)

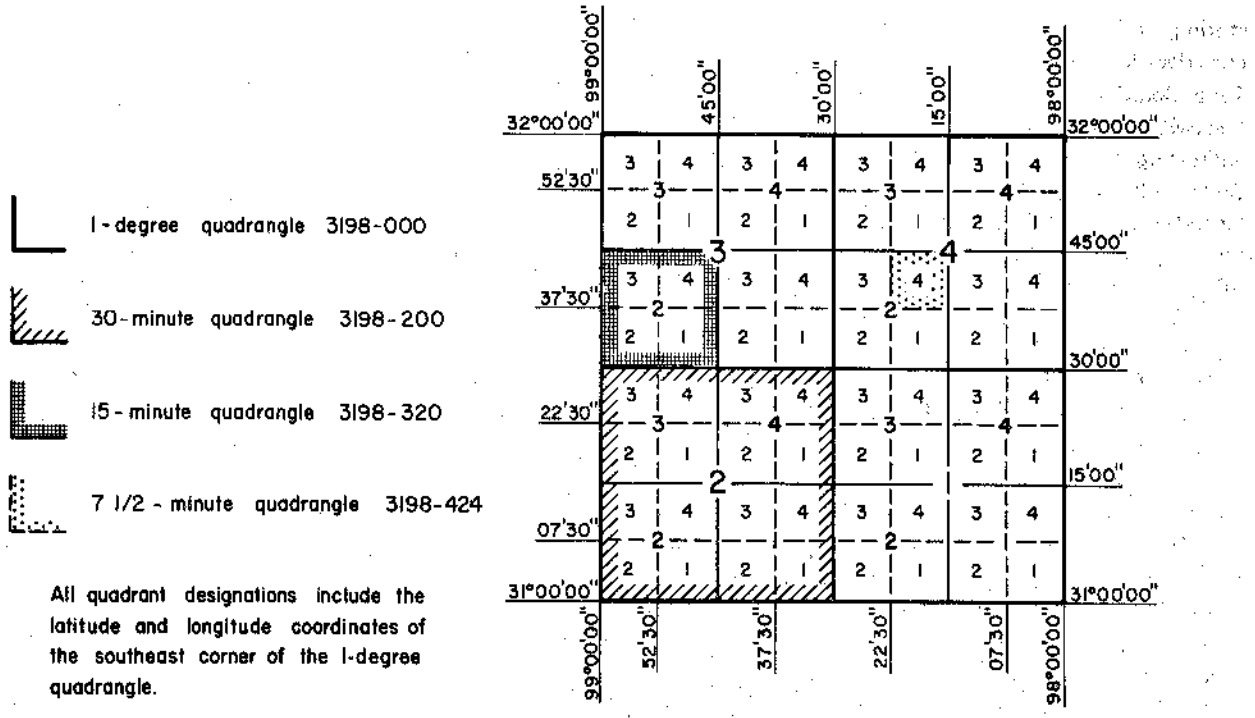


Figure 4.—Diagrammatic Explanation of the Texas Code Index System

imprinting arrangement, countless man-hours will be saved in the processing and filing of maps. By the end of calendar year 1978, the Code Index Number had been imprinted on 406 quadrangles.

The U.S. Geological Survey is also seriously considering using a system patterned after the Texas Code Index for identifying maps all over the United States. The ease with which the Texas Code Index system can be understood and applied to all standard topographic maps published by the U.S. Geological Survey gives it extremely valuable potential for general use in the filing and retrieving of maps.

MAP DISTRIBUTION AND INFORMATION CENTER

When the cooperative mapping program was initiated, many saw the need to create a central map distribution and information office. Envisioned was a center that would be large enough to house and maintain a supply of available U.S. Geological Survey topographic maps. Also, it was thought that such a center should maintain a reference file, to the degree that was practicable, of all available standard maps covering areas of the State.

It was contemplated that the map center should be in a position to provide immediate, up-to-date information on map availability, map sources, and the status of mapping in progress. A resolution recommending establishment of such a center was passed on October 19, 1962, by the Texas Mapping Advisory Committee. Soon thereafter, efforts were put forth by the then Texas Water Commission to develop a map distribution and information center.

Because of its statutorily assigned responsibilities for topographic and geologic mapping in Texas, the Texas Department of Water Resources now houses the Map Distribution and Information Center. The Center is maintained by the Department's Topographic Mapping Unit. Services rendered by the Center reached a level in 1971 that justified establishment of a distribution accounting system.

The Map Distribution and Information Center provides the following services to map users:

1. Furnishes, on request, U.S. Geological Survey topographic maps to State and local governmental entities. These maps can be made available without charge to these agencies of government as a consequence of the Department's participation in the State-federal cooperative mapping program.

2. Provides up-to-date information to all inquirers concerning areas and scales of published map coverage and the status of topographic mapping in progress or programmed.

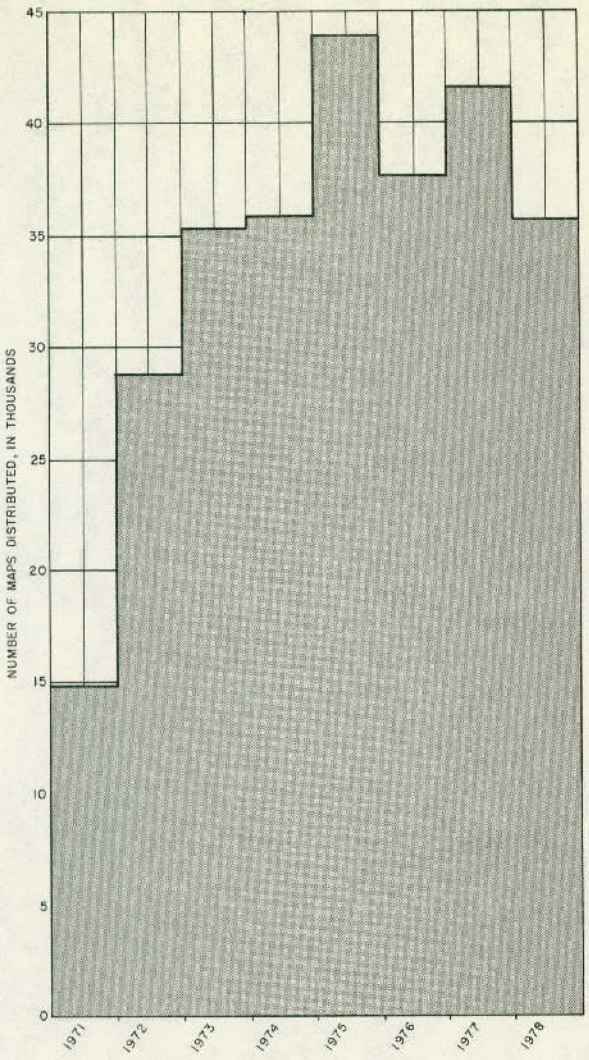


Figure 5.—Maps Distributed by the Map Distribution and Information Center, 1971-78 (Calendar Years)

3. Maintains up-to-date files on National Geodetic Survey Horizontal and Vertical Control Data for Texas.

4. Maintains a map reference library, which includes not only standard topographic maps of areas in Texas but also nautical charts, State highway (county) maps, geologic-atlas sheets, land-use maps, city maps, statewide base maps, historical reclamation maps (prepared by the former State Reclamation Department), national forest maps, lake maps (prepared by reservoir operating entities and private map companies), United States base maps, and Defense Mapping Agency topographic maps. (The library also includes single copies of standard U.S. Geological Survey topographic maps covering the states adjacent to Texas, i.e., New Mexico, Arkansas, Oklahoma, and Louisiana.)

In addition to providing these services to map users, the staff of the Center assists in coordinating the State-federal cooperative mapping program. Also, the staff provides assistance to the Texas Mapping Advisory Committee, which includes preparing for and participating in annual meetings and compiling annual reports to the Chief of the Topographic Division, U.S. Geological Survey.

Expertise with map-related matters and activities in the Map Distribution and Information Center results from the Department's many years of involvement with topographic mapping in Texas. The Center stands ready to provide all possible assistance to map users in Texas. Figure 5 reflects the number of maps distributed by the Map Distribution and Information Center during the years 1971 through 1978. At least 35,000 maps have been distributed by the Center during each of the last 6 years.

HOW TO OBTAIN TOPOGRAPHIC MAPS

The general public may purchase available topographic maps from the U.S. Geological Survey. For additional information and a copy of the latest "Index to Topographic Maps of Texas,"* write:

Branch of Distribution
U.S. Geological Survey
Box 25286
Federal Center, Mail Stop 306
Denver, Colorado 80225

Various governmental agencies that have a need for available 7½-minute series topographic maps may obtain them for official use, without charge, from the Texas Department of Water Resources. For additional information regarding this service, contact:

Texas Department of Water Resources
Topographic Mapping
P. O. Box 13087
Austin, Texas 78711
Phone: Area Code 512 475-3681

CHRONOLOGY OF AUTHORIZATION AND COMPLETION OF MAPPING PROJECTS

Table 1 is a chronology of mapping projects by year initially authorized. The table includes names of 366

*Included in this "Index to Topographic Maps of Texas" is a list of the numerous topographic map dealers in the State where maps may be obtained by over-the-counter sale.

Table 1 -- Mapping By Calendar Year Project Initially Authorized

Year Authorized	Project Name	Year Publication Completed	Number of 7½-Minute Quadrangles Authorized for Mapping: All-Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1947	Annona	1949	23	--		
	Lufkin	1949	8	--		
	Crockett	1950	8	--		
	Colorado City	1952	16	--		
			55		55	55
1948	Bay City	1952	75	--		
	Port Mansfield	1952	23	--		
			98		98	153
1949	Wharton	1953	11	--		
	Borger	1953	24	--		
	San Antonio	1953	16	--		
			51		51	204
1950	Aransas Pass	1954	2	--		
	Texas City	1954	17	--		
	Wiergate	1954	7	--		
	Dermott	1954	3	--		
	Lampasas	1954	8	--		
	La Parra	1954	2	--		
	Texarkana	1954	6	--		
			45		45	249
1951	East Brownsville	1955	12	--		
	Orange	1955	2	--		
	Fort Worth	1955	12	--		
	El Paso	1955	19	--		
	Maud	1955	2	--		
			47		47	296

See footnotes at end of table.

Table 1 -- Mapping By Calendar Year Project Initially Authorized (Continued)

Year Authorized	Project Name	Year Publication Completed	Number of 7½-Minute Quadrangles Authorized for Mapping: All-Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1952	West Brownsville	1956	33	--		
	Amarillo East	1956	4	--		
	Llano North	1956	12	--		
	Mart	1956	8	--		
	Hamilton	1956	32	--		
			89		89	385
1953	Austin*	1955	--	4*		
	Port Arthur	1957	10	--		
	Columbus	1957	3	--		
	Irene	1957	2	--		
	Waco	1957	19	--		
	San Angelo	1957	4	--		
	Abilene	1957	4	--		
	Denison Dam	1957	1	--		
	Lubbock	1957	4	--		
	Wichita Falls	1958	4	--		
			51	4	55	440
1954	Fayetteville	1960	12	--		
	Dallas	1960	24	--		
	Grand Saline	1960	8	--		
	San Saba	1960	12	--		
			56		56	496
1955	Fort Hood-Gray	1961	19	--		
	Breckenridge	1961	2	--		
	McWhorter	1961	6	--		
	Sherman	1961	4	--		
	Pullman	1961	1	--		
	Kelly-Randolph-Brooks	1962	13	--		
			45		45	541

See footnotes at end of table.

Table 1 -- Mapping By Calendar Year Project Initially Authorized (Continued)

Year Authorized	Project Name	Year Publication Completed	Number of 7½-Minute Quadrangles Authorized for Mapping: All-Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1956	La Grange West*	1958	--	5*		
	Weatherford	1960	12	--		
	Denton South	1962	28	--		
			40	5	45	586
1957	Croton Creek	1960	--	8		
	Arlie**	1960	--	2**		
	Groesbeck	1961	--	3		
	San Jacinto*	1961	--	16*		
	Garwood	1962	--	3		
	Cuero-Guadalupe	1962	--	10		
	Cibolo Creek	1962	--	3		
	Spring Creek	1962	--	5		
	Carlos	1962	--	1		
	Gilmer West	1962	24	--		
	Navasota-Yegua	1963	--	19		
	Salt Fork	1963	--	7		
	Denton North	1964	36	--		
	Gilmer East	1964	24	--		
	Waskom	1964	4	--		
			88	77	165	751
1958	Sealy	1962	10	--		
	Llano South	1962	2	--		
	Amarillo West	1962	4	--		
	Jacksboro	1963	4	--		
	Waxahachie	1963	20	--		
	Navasota	1964	2	--		
			42		42	793

See footnotes at end of table.

Table 1 -- Mapping By Calendar Year Project Initially Authorized (Continued)

Year Authorized	Project Name	Year Publication Completed	Number of 7½-Minute Quadrangles Authorized for Mapping: All-Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1959	Trenton**	1962	--	3**		
	Beaumont	1962	4	--		
	San Jacinto Extension	1964	--	3		
	Falls City	1964	18	--		
	Cologne	1964	8	--		
	Marlin	1964	16	--		
			46	6	52	845
1960	Cedar-Chambers	1962	--	11		
	Brady	1962	--	3		
	Pedernales**	1962	--	5**		
	Utopia**	1962	--	2**		
	Hayrick	1962	--	6		
	Coleman	1962	--	6		
	Uvalde	1962	--	4		
	Rosser**	1962	--	2**		
	Breckenridge South**	1962	--	2**		
	Porterville	1963	--	7		
	Trinity	1963	--	16		
	Post	1963	--	3		
	Stephenville**	1963	--	5**		
	Anahuac	1964	29	--		
	Caldwell	1964	7	--		
	Singleton	1964	6	--		
	Robert Lee	1964	4	--		
			46	72	118	963

See footnotes at end of table.

Table 1 -- Mapping By Calendar Year Project Initially Authorized (Continued)

Year Authorized	Project Name	Year Publication Completed	Number of 7½-Minute Quadrangles Authorized for Mapping: All-Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1961	Hempstead	1963	--	4		
	Sample	1963	--	3		
	Rockwood	1964	10	--		
	Madisonville West	1964	4	--		
	Louetta North	1964	3	--		
	Louetta	1964	3	--		
	Greenville	1964	--	4		
	Sterling City	1964	--	1		
	Brady Southwest	1964	--	1		
	Fredonia	1965	8	--		
	Ben Bolt	1965	12	--		
	Premont	1965	8	--		
	Hidalgo	1965	23	--		
	Archer City	1965	--	5		
	Taylor	1965	--	6		
	Millers Creek	1965	--	4		
	Bryan	1965	--	4		
	Wheeler	1965	--	10		
	Canada	1965	--	2		
	Flatonia	1965	--	2		
	Kaufman	1966	14	--		
	Ennis	1966	--	8		
	Wills Point	1966	--	9		
	Aspermont	1966	--	4		
	Leander	1966	--	4		
	Warda	1966	--	1		
	Madisonville	1966	--	5		
	Oakville	1966	--	2		
	Hallettsville	1966	--	7		

See footnotes at end of table.

Table 1 -- Mapping By Calendar Year Project Initially Authorized (Continued)

Year Authorized	Project Name	Year Publication Completed	Number of 7½-Minute Quadrangles Authorized for Mapping: All-Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1961 (Cont'd)	Monthalia	1966	--	2		
	Barstow	1967	--	8		
	Sulphur Springs**	1967	--	3**		
	Alvin	1968	16	--		
			101	99	200	1,163
1962	Wheelock	1964	5	--		
	Edgar	1964	6	--		
	Cunningham	1965	4	--		
	Garden City	1965	8	--		
	Garden City West	1965	4	--		
	Crockett	1965	8	--		
	Wheeler North	1965	--	2		
	Hansford	1965	--	5		
	Port McKavett	1966	20	--		
	Bellville	1966	9	--		
	Weesatche	1966	16	--		
	Muleshoe**	1966	--	7**		
	Silverton	1967	13	--		
	Manning	1967	8	--		
	Littlefield	1967	--	15		
	Slaton	1967	--	10		
	Muleshoe II	1967	--	21		
	Dumas	1968	--	24		
	Floydada	1968	--	10		
	Pampa	1968	--	11		
			101	105	206	1,369

See footnotes at end of table.

Table 1 -- Mapping By Calendar Year Project Initially Authorized (Continued)

Year Authorized	Project Name	Year Publication Completed	Number of 7½-Minute Quadrangles Authorized for Mapping: All-Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1963	Blanco	1965	9	--		
	Canadian	1966	4	--		
	Odessa	1966	4	--		
	Wortham	1966	6	--		
	Lott	1966	6	--		
	Hunter	1966	2	--		
	Camp Gary	1966	13	--		
	Pettus	1966	4	--		
	Berclair	1966	2	--		
	Cain City	1966	--	2		
	La Coste	1966	--	2		
	Lockhart	1966	--	2		
	Saspamco	1966	--	2		
	Wheeler South	1967	18	--		
	Tule Creek	1967	8	--		
	Odessa West	1967	12	--		
	Leona	1967	24	--		
	Sonora	1967	12	--		
	Bartlett	1967	13	--		
	Yancey	1967	10	--		
	Kerrville	1967	29	--		
	Natalia	1967	--	2		
	Sierra Blanca	1968	16	--		
	San Marcos	1968	9	--		
	Cooper	1968	--	23		
	Boerne	1968	--	15		
	Olney	1968	--	27		
	Tulia	1969	--	20		
	Houston	1970	12	--		
			213	95	308	1,677

See footnotes at end of table.

Table 1 -- Mapping By Calendar Year Project Initially Authorized (Continued)

Year Authorized	Project Name	Year Publication Completed	Number of 7½-Minute Quadrangles Authorized for Mapping: All-Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1964	Midland	1967	12	--		
	Corsicana	1968	11	--		
	Buffalo	1968	15	--		
	Schulenburg	1968	7	--		
	Moulton	1968	12	--		
	Laredo	1968	11	--		
	El Campo	1968	9	--		
	Dublin	1968	11	--		
	Albany	1968	26	--		
	Naples	1968	8	--		
	Mt. Pleasant	1968	24	--		
	Rio Grande	1969	15	--		
	Whitsett	1969	8	--		
	Temple	1969	8	--		
	Hillsboro	1969	--	8		
	Walnut Springs	1969	--	7		
	Rising Star	1969	--	6		
	Friona	1969	--	8		
	Matador	1969	--	6		
	Crosbyton	1969	--	12		
	Tyler	1970	8	--		
	Truscott	1970	--	14		
	Lefors	1970	--	16		
			185	77	262	1,939
1965	Midkiff	1970	8	--		
	Scharbauer	1970	8	--		
	Seymour	1970	21	--		

See footnotes at end of table.

Table 1 -- Mapping By Calendar Year Project Initially Authorized (Continued)

Year Authorized	Project Name	Year Publication Completed	Number of 7½-Minute Quadrangles Authorized for Mapping: All-Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1965 (Cont'd)	Throckmorton	1970	22	--		
	Stanton	1970	24	--		
	Farrar	1970	11	--		
	Fredericksburg	1971	43	--		
	Ozona	1971	44	--		
	Ballinger	1971	36	--		
	Graham	1971	18	--		
	Munday	1971	16	--		
	Hale Center	1971	10	--		
	Cisco	1971	16	--		
	Dickens	1971	--	33		
	Childress	1971	--	33		
	Monahans	1971	--	6		
	Grand Falls	1971	--	9		
	Sweetwater	1973	48	--		
			325	81	406	2,345
1966	Vega	1970	28	--		
	Kress	1971	8	--		
	Orla	1971	6	--		
	Longfellow	1971	16	--		
	London	1971	2	--		
	Pleasanton	1971	14	--		
	Benavides	1971	8	--		
	Hebbronville	1971	16	--		
	Nocona	1971	18	--		
	Beaver Creek	1971	--	2		
	Blum	1971	--	4		

See footnotes at end of table.

Table 1 -- Mapping By Calendar Year Project Initially Authorized (Continued)

Year Authorized	Project Name	Year Publication Completed	Number of 7½-Minute Quadrangles Authorized for Mapping: All-Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1966 (Cont'd)	Three Rivers	1971	--	4		
	Hobbs	1972	2	--		
	Hobbs North	1972	2	--		
	Tucumcari	1972	4	--		
	Outer Austin	1972	12	--		
	Mason	1972	--	4		
	Fowlerton	1972	--	18		
	Comanche	1973	--	15		
	Sabinal	1973	--	11		
			136	58	194	2,539
1967	Goodland	1971	--	3		
	Enochs	1971	--	3		
	Cross Plains	1971	--	3		
	Corpus Christi	1972	8	--		
	Rosita	1972	8	--		
	Loma Alta	1972	4	--		
	Brownfield	1972	--	25		
	New Lynn	1972	--	4		
	Robstown	1973	12	--		
	Centralia Draw	1973	3	--		
	Kermit West	1973	6	--		
	Eunice	1973	4	--		
	Tatum	1973	4	--		
	Hondo	1973	6	--		
	Kickapoo	1973	8	--		
	Juno	1973	20	--		
	Sanderson	1973	32	--		
	Rankin	1973	17	--		

See footnotes at end of table.

Table 1 -- Mapping By Calendar Year Project Initially Authorized (Continued)

Year Authorized	Project Name	Year Publication Completed	Number of 7½-Minute Quadrangles Authorized for Mapping: All-Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1967 (Cont'd)	Kermit	1973	5	--		
	Atlanta	1973	8	--		
	Garza	1973	--	22		
			145	60	205	2,744
1968	Fort Stockton	1973	16	--		
	Clayton	1973	4	--		
	Grady	1973	2	--		
	Menard	1973	26	--		
	Pipe Creek	1973	3	--		
	Addicks	1973	5	--		
	Sugar Land	1973	3	--		
	Causey	1973	4	--		
	Saddle Butte	1973	--	4		
	Hereford	1974	12	--		
	Romero	1974	12	--		
	Canadian	1974	12	10		
	Reynolds Creek	1974	--	11		
	Channing	1974	--	12		
	Andrews	1974	--	20		
	Seminole	1974	--	30		
	Morton	1974	--	12		
	Pecos	1974	--	24		
			87	123	210	2,954
1969	Brookshire	1974	6	--		
	Katy	1974	2	--		
	Big Bend	1974	40	--		
	Paint Creek	1974	5	--		

See footnotes at end of table.

Table 1 -- Mapping By Calendar Year Project Initially Authorized (Continued)

Year Authorized	Project Name	Year Publication Completed	Number of 7½-Minute Quadrangles Authorized for Mapping: All-Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1969 (Cont'd)	Uvalde	1974	18	--		
	Plains	1974	--	16		
	Kilgore	1974	--	4		
	Big Spring	1974	--	8		
	Big Lake	1974	--	10		
	Crane	1974	--	4		
	Rock Springs	1974	--	14		
	Freer	1974	--	4		
	La Gloria	1976	36	--		
			107	60	167	3,121
1970	Charlie	1975	4	--		
	Christoval	1975	23	--		
	Del Rio	1975	17	--		
	Eagle Mountain	1975	16	--		
	Higgins	1975	16	--		
	McCamey	1975	12	--		
	Iowa Park	1975	5	--		
	Fort Hancock	1975	--	13		
	Sunray	1975	--	6		
	Chispa	1975	--	5		
	Alpine	1976	16	--		
	Crystal City	1976	16	--		
	Indian Canyon	1976	--	3		
	Langtry	1976	--	4		
	Buckley Creek	1976	--	6		
	Troup	1977	--	24		
	Barksdale	1977	--	3		
			125	64	189	3,310

See footnotes at end of table.

Table 1 -- Mapping By Calendar Year Project Initially Authorized (Continued)

Year Authorized	Project Name	Year Publication Completed	Number of 7½-Minute Quadrangles Authorized for Mapping: All-Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1971	Dalhart	1976	26	--		
	Perryton	1976	20	--		
	Black Creek	1977	8	--		
	Ketchum Mountain	1977	16	--		
	Signal Peak	1977	20	--		
	Waldrip	1977	4	--		
			94		94	3,404
1972	Cline	1977	4	--		
	Crane	1977	8	--		
	Delaware	1977	32	--		
	Gruver	1977	19	--		
	Grand Falls	1977	8	--		
	Junction	1977	12	--		
	Paloma	1977	1	--		
	Woodward	1977	4	--		
	Divot	1977	--	6		
	Brackettville	1977	--	17		
	Cotulla	1977	--	13		
	Chinati Peak	I	21	--		
	Valentine	I	21	--		
	Woodsboro	I	16	--		
	Spofford	1978	--	14		
			146	50	196	3,600
1973	Chancellor	I	24	--		
	Eagle Pass	I	45	--		
	Elgin	I	20	--		
	Malvado	I	15	--		
	Marfa	I	34	--		

See footnotes at end of table.

Table 1 -- Mapping By Calendar Year Project Initially Authorized (Continued)

Year Authorized	Project Name	Year Publication Completed	Number of 7½-Minute Quadrangles Authorized for Mapping: All-Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1973 (Cont'd)	Santiago Peak	I	51	--		
	Zapata	I	36	--		
	Kingsville	I	--	32		
	Carta Valley	I	--	28		
	Borrego	I	--	10		
			225	70	295	3,895
1974	Carthage	I	20	--		
	Liberty	I	32	--		
	Marathon	I	16	--		
	Starks	I	5	--		
	Triple Hill	I	--	4		
	Hueco Mts.	I	--	8		
	Brownwood	I	--	20		
	Emory	I	--	8		
			73	40	113	4,008
1975	Athens	I	16	--		
	Jasper	I	24	--		
	Miles	I	20	--		
	Kingston	I	11	--		
	Durant	I	12	--		
	Jacksonville	I	--	20		
	Bonham	I	--	16		
	Livingston	I	--	8		
	Douglass	I	--	8		
			83	52	135	4,143

See footnotes at end of table.

Table 1 -- Mapping By Calendar Year Project Initially Authorized (Continued)

Year Authorized	Project Name	Year Publication Completed	Number of 7½-Minute Quadrangles Authorized for Mapping: All-Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1976	Goodlett	I	10	--		
	Mineral Wells	I	16	--		
	Camden	I	36	--		
	Noodle	I	20	--		
	San Augustine	I	--	21		
	Vernon	I	--	10		
	Abernathy	I	--	20		
	Wildorado	I	--	8		
	Canyon	I	--	7		
	Goodnight	I	--	8		
			82	74	156	4,299
1977	Quanah	I	27	--		
	Huxley	I	7			
			34		34	4,333
1978	Clovis	I	6	--		
			6		6	4,339

* No State funding in this project. Local cooperator and Federal government provided the financial support to this project.

** Local cooperator provided financial support to this project, in addition to the State-Federal cooperation indicated.

I Publication incomplete as of December 31, 1978.

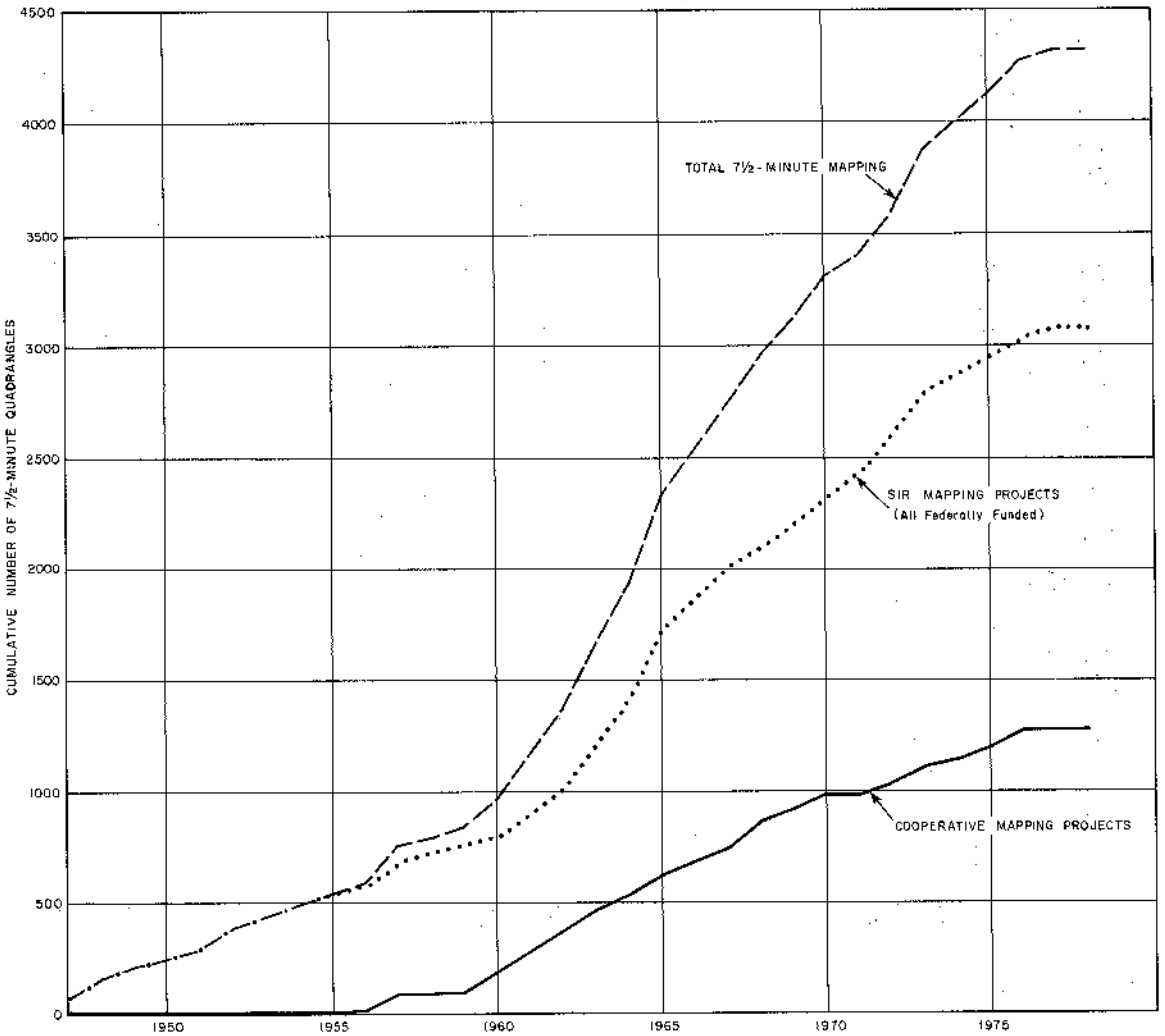


Figure 6.—7½-Minute Quadrangles Authorized by Projects Under the National Mapping Program in Texas (Cumulatively Shown for the Calendar Year Period 1947-78)

projects (both Cooperative and SIR), number of quadrangles in each project, year initially authorized, and completion date. Reflected also is a cumulative total for each year beginning in 1947 and ending in 1978. Figure 6 charts the cumulative total number of 7½-minute quadrangles authorized under the National Topographic Mapping Program in Texas. The chart shows both Cooperative and SIR Mapping Programs as well as the combined total of the two.

Table 2 is a chronology of mapping projects (Cooperative and SIR) by year projects were actually completed from 1949 through 1978. Figure 7 charts this progression cumulatively. A project was considered completed when all published 7½-minute maps in the project were received by the Department. Due to limitations in capability in the printing process, many projects were delayed in their completion. Also, variations in the number of 7½-minute maps comprising mapping projects may tend to cause confusion about the actual number of quadrangles published. For example, in 1966 a total of 26 projects were completed but only 157 (7½-minute) quadrangles were actually involved. In 1971 a total of 25 mapping projects were completed, but 371 (7½-minute) quadrangles were involved in the mapping program for that year. Thus, 1971 saw the largest number of 7½-minute quadrangles involved in completed mapping projects since the modern-day-mapping program began in 1947. Both Tables 1 and 2 show the number of 7½-minute quadrangles in each project. The Spofford project includes 14 (7½-minute) quadrangles. Thirteen quadrangles were received in 1977, and the remaining quadrangle was received in 1978. Therefore, the Spofford project was considered complete in 1978.

The "Index to Topographic Maps of Texas" and the Texas Department of Water Resources' "Record of Receipt" system were utilized in compiling both chronology listings.

The time frame between authorization date and completion date is usually from 4 to 5 years. Some of the

Table 2 -- Mapping By Calendar Year Project Completed

Year Project Completed	Project Name	Year Initially Authorized	Number of 7½-Minute Quadrangle Maps Published: All-Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1949	Annona	1947	23	--		
	Lufkin	1947	8	--		
			31		31	31
1950	Crockett	1947	8	--		
			8		8	39
1951	No Projects	--	--	--	--	39
1952	Colorado City	1947	16	--		
	Bay City	1948	75	--		
	Port Mansfield	1948	23	--		
			114		114	153
1953	Wharton	1949	11	--		
	Borger	1949	24	--		
	San Antonio	1949	16	--		
			51		51	204
1954	Aransas Pass	1950	2	--		
	Texas City	1950	17	--		
	Wiergate	1950	7	--		
	Dermott	1950	3	--		
	Lampasas	1950	8	--		
	La Parra	1950	2	--		
	Texarkana	1950	6	--		
			45		45	249

See footnotes at end of table.

Table 2 -- Mapping By Calendar Year Project Completed

Year Project Completed	Project Name	Year Initially Authorized	Number of 7½-Minute Quadrangle Maps Published			
			All-Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1955	East Brownsville	1951	12	--		
	Orange	1951	2	--		
	Fort Worth	1951	12	--		
	El Paso	1951	19	--		
	Maud	1951	2	--		
	Austin*	1953	--	4*		
			47	4	51	300
1956	West Brownsville	1952	33	--		
	Amarillo East	1952	4	--		
	Llano North	1952	12	--		
	Mart	1952	8	--		
	Hamilton	1952	32	--		
			89		89	389
1957	Port Arthur	1953	10	--		
	Columbus	1953	3	--		
	Irene	1953	2	--		
	Waco	1953	19	--		
	San Angelo	1953	4	--		
	Abilene	1953	4	--		
	Denison Dam	1953	1	--		
	Lubbock	1953	4	--		
			47		47	436
1958	Wichita Falls	1953	4	--		
	La Grange West*	1956	--	5*		
			4	5	9	445

See footnotes at end of table.

Table 2 -- Mapping By Calendar Year Project Completed

Year Project Completed	Project Name	Year Initially Authorized	Number of 7½-Minute Quadrangle Maps Published: All-Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1959	No Projects	--	--	--	--	445
1960	Fayetteville	1954	12	--		
	Dallas	1954	24	--		
	Grande Saline	1954	8	--		
	San Saba	1954	12	--		
	Weatherford	1956	12	--		
	Croton Creek	1957	--	8		
	Arlie**	1957	--	2**		
			68	10	78	523
1961	Fort Hood-Gray	1955	19	--		
	Breckenridge	1955	2	--		
	McWhorter	1955	6	--		
	Sherman	1955	4	--		
	Pullman	1955	1	--		
	Groesbeck	1957	--	3		
	San Jacinto*	1957	--	16*		
			32	19	51	574
1962	Kelly-Randolph-Brooks	1955	13	--		
	Denton South	1956	28	--		
	Gilmer West	1957	24	--		
	Garwood	1957	--	3		
	Cuero-Guadalupe	1957	--	10		
	Cibolo Creek	1957	--	3		
	Spring Creek	1957	--	5		

See footnotes at end of table.

Table 2 -- Mapping By Calendar Year Project Completed

Year Project Completed	Project Name	Year Initially Authorized	Number of 7½-Minute Quadrangle Maps Published: All-Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1962 (Cont'd)	Carlos	1957	--	1		
	Sealy	1958	10	--		
	Llano South	1958	2	--		
	Amarillo West	1958	4	--		
	Beaumont	1959	4	--		
	Trenton**	1959	--	3**		
	Cedar-Chambers	1960	--	11		
	Brady	1960	--	3		
	Pedernales**	1960	--	5**		
	Utopia**	1960	--	2**		
	Hayrick	1960	--	6		
	Coleman	1960	--	6		
	Uvalde	1960	--	4		
	Rosser**	1960	--	2**		
	Breckenridge South**	1960	--	2**		
			85	66	151	725
1963	Navasota-Yegua	1957	--	19		
	Salt Fork	1957	--	7		
	Jacksboro	1958	4	--		
	Waxahachie	1958	20	--		
	Porterville	1960	--	7		
	Trinity	1960	--	16		
	Post	1960	--	3		
	Stephenville**	1960	--	5**		
	Hempstead	1961	--	4		
	Sample	1961	--	3		
			24	64	88	813

See footnotes at end of table.

Table 2 -- Mapping By Calendar Year Project Completed

Year Project Completed	Project Name	Year Initially Authorized	Number of 7½-Minute Quadrangle Maps Published: All-Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1964	Denton North	1957	36	--		
	Gilmer East	1957	24	--		
	Waskom	1957	4	--		
	Navasota	1958	2	--		
	Falls City	1959	18	--		
	Cologne	1959	8	--		
	Marlin	1959	16	--		
	San Jacinto Extension	1959	--	3		
	Anahuac	1960	29	--		
	Caldwell	1960	7	--		
	Singleton	1960	6	--		
	Robert Lee	1960	4	--		
	Rockwood	1961	10	--		
	Madisonville West	1961	4	--		
	Louetta North	1961	3	--		
	Louetta	1961	3	--		
	Greenville	1961	--	4		
	Sterling City	1961	--	1		
	Brady SW	1961	--	1		
	Wheelock	1962	5	--		
	Edger	1962	6	--		
			185	9	194	1,007
1965	Fredonia	1961	8	--		
	Ben Bolt	1961	12	--		
	Premont	1961	8	--		
	Hidalgo	1961	23	--		
	Archer City	1961	--	5		

See footnotes at end of table.

Table 2 -- Mapping By Calendar Year Project Completed

Year Project Completed	Project Name	Year Initially Authorized	Number of 7½-Minute Quadrangle Maps Published: All-Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1965 (Cont'd)	Taylor	1961	--	6		
	Millers Creek	1961	--	4		
	Bryan	1961	--	4		
	Wheeler	1961	--	10		
	Ganada	1961	--	2		
	Flatonia	1961	--	2		
	Cunningham	1962	4	--		
	Garden City	1962	8	--		
	Garden City West	1962	4	--		
	Crockett	1962	8	--		
	Wheeler North	1962	--	2		
	Hansford	1962	--	5		
	Blanco	1963	9	--		
			84	40	124	1,131
1966	Kaufman	1961	14	--		
	Ennis	1961	--	8		
	Wills Point	1961	--	9		
	Aspermont	1961	--	4		
	Leander	1961	--	4		
	Warda	1961	--	1		
	Madisonville	1961	--	5		
	Oakville	1961	--	2		
	Hallettsville	1961	--	7		
	Monthalia	1961	--	2		
	Fort McKavett	1962	20	--		
	Bellville	1962	9	--		
	Weesatche	1962	16	--		
	Muleshoe**	1962	--	7**		

See footnotes at end of table.

Table 2 -- Mapping By Calendar Year Project Completed

Year Project Completed	Project Name	Year Initially Authorized	Number of 7½-Minute Quadrangle Maps Published: All-Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1966 (Cont'd)	Canadian	1963	4	--		
	Odessa	1963	4	--		
	Wortham	1963	6	--		
	Lott	1963	6	--		
	Hunter	1963	2	--		
	Camp Gary	1963	13	--		
	Pettus	1963	4	--		
	Berclair	1963	2	--		
	Cain City	1963	--	2		
	La Coste	1963	--	2		
	Lockhart	1963	--	2		
	Saspamco	1963	--	2		
			100	57	157	1,288
1967	Barstow	1961	--	8		
	Sulphur Springs**	1961	--	3**		
	Silverton	1962	13	--		
	Manning	1962	8	--		
	Littlefield	1962	--	15		
	Slaton	1962	--	10		
	Muleshoe II	1962	--	21		
	Wheeler South	1963	18	--		
	Tule Creek	1963	8	--		
	Odessa West	1963	12	--		
	Leona	1963	24	--		
	Sonora	1963	12	--		
	Bartlett	1963	13	--		
	Yancey	1963	10	--		

See footnotes at end of table.

Table 2 -- Mapping By Calendar Year Project Completed

Year Project Completed	Project Name	Year Initially Authorized	Number of 7½-Minute Quadrangle Maps Published: All-Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1967 (Cont'd)	Kerrville	1963	29	--		
	Natalia	1963	--	2		
	Midland	1964	12	--		
			159	59	218	1,506
1968	Alvin	1961	16	--		
	Dumas	1962	--	24		
	Floydada	1962	--	10		
	Pampa	1962	--	11		
	Sierra Blanca	1963	16	--		
	San Marcos	1963	9	--		
	Cooper	1963	--	23		
	Boerne	1963	--	15		
	Olney	1963	--	27		
	Corsicana	1964	11	--		
	Buffalo	1964	15	--		
	Schulenburg	1964	7	--		
	Moulton	1964	12	--		
	Laredo	1964	11	--		
	El Campo	1964	9	--		
	Dublin	1964	11	--		
	Albany	1964	26	--		
	Naples	1964	8	--		
	Mt. Pleasant	1964	24	--		
			175	110	285	1,791

See footnotes at end of table.

Table 2 -- Mapping By Calendar Year Project Completed

Year Project Completed	Project Name	Year Initially Authorized	Number of 7½-Minute Quadrangle Maps Published			
			All-Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1969	Tulia	1963	--	20		
	Rio Grande	1964	15	--		
	Whitsett	1964	8	--		
	Temple	1964	8	--		
	Hillsboro	1964	--	8		
	Walnut Springs	1964	--	7		
	Rising Star	1964	--	6		
	Friona	1964	--	8		
	Matador	1964	--	6		
	Crosbyton	1964	--	12		
			31	67	98	1,889
1970	Houston	1963	12	--		
	Tyler	1964	8	--		
	Truscott	1964	--	14		
	Lefors	1964	--	16		
	Midkiff	1965	8	--		
	Scharbauer	1965	8	--		
	Seymour	1965	21	--		
	Throckmorton	1965	22	--		
	Stanton	1965	24	--		
	Farrar	1965	11	--		
	Vega	1966	28	--		
			142	30	172	2,061
1971	Fredericksburg	1965	43	--		
	Ozona	1965	44	--		
	Ballinger	1965	36	--		

See footnotes at end of table.

Table 2 -- Mapping By Calendar Year Project Completed

Year Project Completed	Project Name	Year Initially Authorized	Number of 7½-Minute Quadrangle Maps Published: All Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1971 (Cont'd)	Graham	1965	18	--		
	Munday	1965	16	--		
	Hale Center	1965	10	--		
	Cisco	1965	16	--		
	Dickens	1965	--	33		
	Childress	1965	--	33		
	Monahans	1965	--	6		
	Grandfalls	1965	--	9		
	Kress	1966	8	--		
	Orla	1966	6	--		
	Longfellow	1966	16	--		
	London	1966	2	--		
	Pleasanton	1966	14	--		
	Benavides	1966	8	--		
	Hebbronville	1966	16	--		
	Nocona	1966	18	--		
	Beaver Creek	1966	--	2		
	Blum	1966	--	4		
	Three Rivers	1966	--	4		
	Goodland	1967	--	3		
	Enochs	1967	--	3		
	Cross Plains	1967	--	3		
			271	100	371	2,432
1972	Hobbs	1966	2	--		
	Hobbs North	1966	2	--		
	Tucumcari	1966	4	--		

See footnotes at end of table.

Table 2 -- Mapping By Calendar Year Project Completed

Year Project Completed	Project Name	Year Initially Authorized	Number of 7½-Minute Quadrangle Maps Published			
			All Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1972 (Cont'd)	Outer Austin	1966	12	--		
	Mason	1966	--	4		
	Fowlerton	1966	--	18		
	Corpus Christi	1967	8	--		
	Rosita	1967	8	--		
	Loma Alto	1967	4	--		
	Brownfield	1967	--	25		
	New Lynn	1967	--	4		
			40	51	91	2,523
1973	Sweetwater	1965	48	--		
	Comanche	1966	--	15		
	Sabinal	1966	--	11		
	Robstown	1967	12	--		
	Centralia Draw	1967	3	--		
	Kermit West	1967	6	--		
	Eunice	1967	4	--		
	Tatum	1967	4	--		
	Hondo	1967	6	--		
	Kickapoo	1967	8	--		
	Juno	1967	20	--		
	Sanderson	1967	32	--		
	Rankin	1967	17	--		
	Kermit	1967	5	--		
	Atlanta	1967	8	--		
	Garza	1967	--	22		
	Fort Stockton	1968	16	--		

See footnotes at end of table.

Table 2 -- Mapping By Calendar Year Project Completed

Year Project Completed	Project Name	Year Initially Authorized	Number of 7½-Minute Quadrangle Maps Published: All Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1973 (Cont'd)	Clayton	1968	4	--		
	Grady	1968	2	--		
	Menard	1968	26	--		
	Pipe Creek	1968	3	--		
	Addicks	1968	5	--		
	Sugar Land	1968	3	--		
	Causey	1968	4	--		
	Saddle Butte	1968	--	4		
			236	52	288	2,811
1974	Hereford	1968	12	--		
	Romero	1968	12	--		
	Canadian	1968	--	10		
	Reynolds Creek	1968	--	11		
	Channing	1968	--	12		
	Andrews	1968	--	20		
	Seminole	1968	--	30		
	Morton	1968	--	12		
	Pecos	1968	--	24		
	Brookshire	1969	6	--		
	Katy	1969	2	--		
	Big Bend	1969	40	--		
	Paint Creek	1969	5	--		
	Uvalde	1969	18	--		
	Plains	1969	--	16		
	Kilgore	1969	--	4		
	Big Spring	1969	--	8		

See footnotes at end of table.

Table 2 -- Mapping By Calendar Year Project Completed

Year Project Completed	Project Name	Year Initially Authorized	Number of 7½-Minute Quadrangle Maps Published: All Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1974 (Cont'd)	Big Lake	1969	--	10		
	Crane	1969	--	4		
	Rock Springs	1969	--	14		
	Freer	1969	--	4		
			95	179	274	3,085
1975	Charlie	1970	4	--		
	Christoval	1970	23	--		
	Del Rio	1970	17	--		
	Eagle Mountain	1970	16	--		
	Higgins	1970	16	--		
	McCamey	1970	12	--		
	Iowa Park	1970	5	--		
	Fort Hancock	1970	--	13		
	Sunray	1970	--	6		
	Chispa	1970	--	5		
			93	24	117	3,202
1976	La Gloria	1969	36	--		
	Alpine	1970	16	--		
	Crystal City	1970	16	--		
	Indian Canyon	1970	--	3		
	Langtry	1970	--	4		
	Buckley Creek	1970	--	6		
	Dalhart	1971	26	--		
	Perryton	1971	20	--		
			114	13	127	3,329

See footnotes at end of table.

Table 2 -- Mapping By Calendar Year Project Completed

Year Project Completed	Project Name	Year Initially Authorized	Number of 7½-Minute Quadrangle Maps Published: All Federal (SIR) Projects	State-Federal (Cooperative) Projects	Total All Projects	Cumulative Total
1977	Barksdale	1970	--	3		
	Troup	1970	--	24		
	Black Creek	1971	8	--		
	Ketchum Mountain	1971	16	--		
	Signal Peak	1971	20	--		
	Waldrip	1971	4	--		
	Cline	1972	4	--		
	Crane	1972	8	--		
	Delaware Creek	1972	32	--		
	Gruver	1972	19	--		
	Grand Falls	1972	8	--		
	Junction	1972	12	--		
	Paloma	1972	1	--		
	Woodward	1972	4	--		
	Divot	1972	--	6		
	Brackettville	1972	--	17		
	Cotulla	1972	--	13		
			136	63	199	3,528
1978	Spofford	1972	--	14		
				14	14	3,542

* No State funding in this project. Local cooperator and Federal government provided the financial support to the project.

** Local cooperator provided financial support to this project, in addition to the State-Federal cooperation indicated.

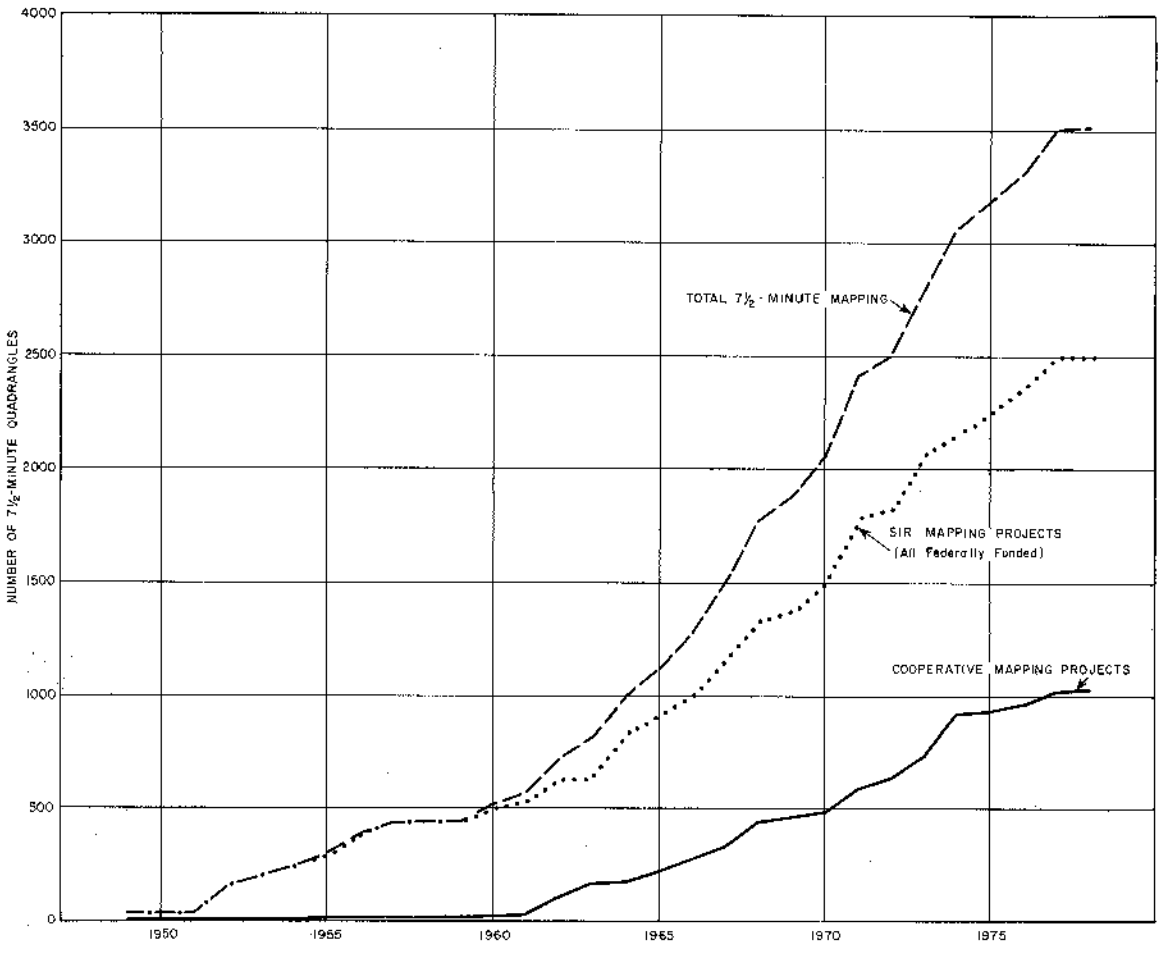


Figure 7.—7½-Minute Quadrangles Published by Projects Under the National Mapping Program in Texas (Cumulatively Shown for the Calendar Year Period 1949-78)

early mapping projects, as reflected on the tables, were completed in a shorter time frame than those completed in later years. This is due in part to incomplete records for those projects initiated in the early years of the mapping program. When the current State-federal cooperative program got underway, a more complete record-keeping system was implemented.

Actual work on a mapping project usually begins 1 year after authorization. Also, as explained earlier, sometimes a single quadrangle can be backlogged in the printing process, and thus delay completion of a project by 1 or even 2 years. An understanding of these factors helps explain the time frame involved between authorization and completion.

Figures 8 and 9 reflect, by convenient increments of years, the authorization and publication dates of 7½-minute mapping projects in Texas.

OTHER AVAILABLE MAPPING

The 1:24,000-scale, 7½-minute quadrangle map, which is the subject of this report, is actually the base product from which a number of other types of maps are derived. As noted earlier, 82 percent of the State's area is covered with published 7½-minute series maps, and the date for completing the coverage of the State is difficult to project.

The largest map stocked by the Map Distribution and Information Center is the U.S. Geological Survey 1:500,000-scale map. This map, which was compiled in 1962 and published in 1965, comes in 4 sections. When spliced, the sections measure 8 feet 6 inches in width by nearly 7 feet in height, and the map has seen considerable use as a wall map to provide a good overview of the entire State. The contour interval is 200 feet, with a supplemental 100-foot contour in the coastal area.

Figure 8

Authorization Dates of 7½-Minute Mapping in Texas, 1947 - 1978 (Calendar Years)

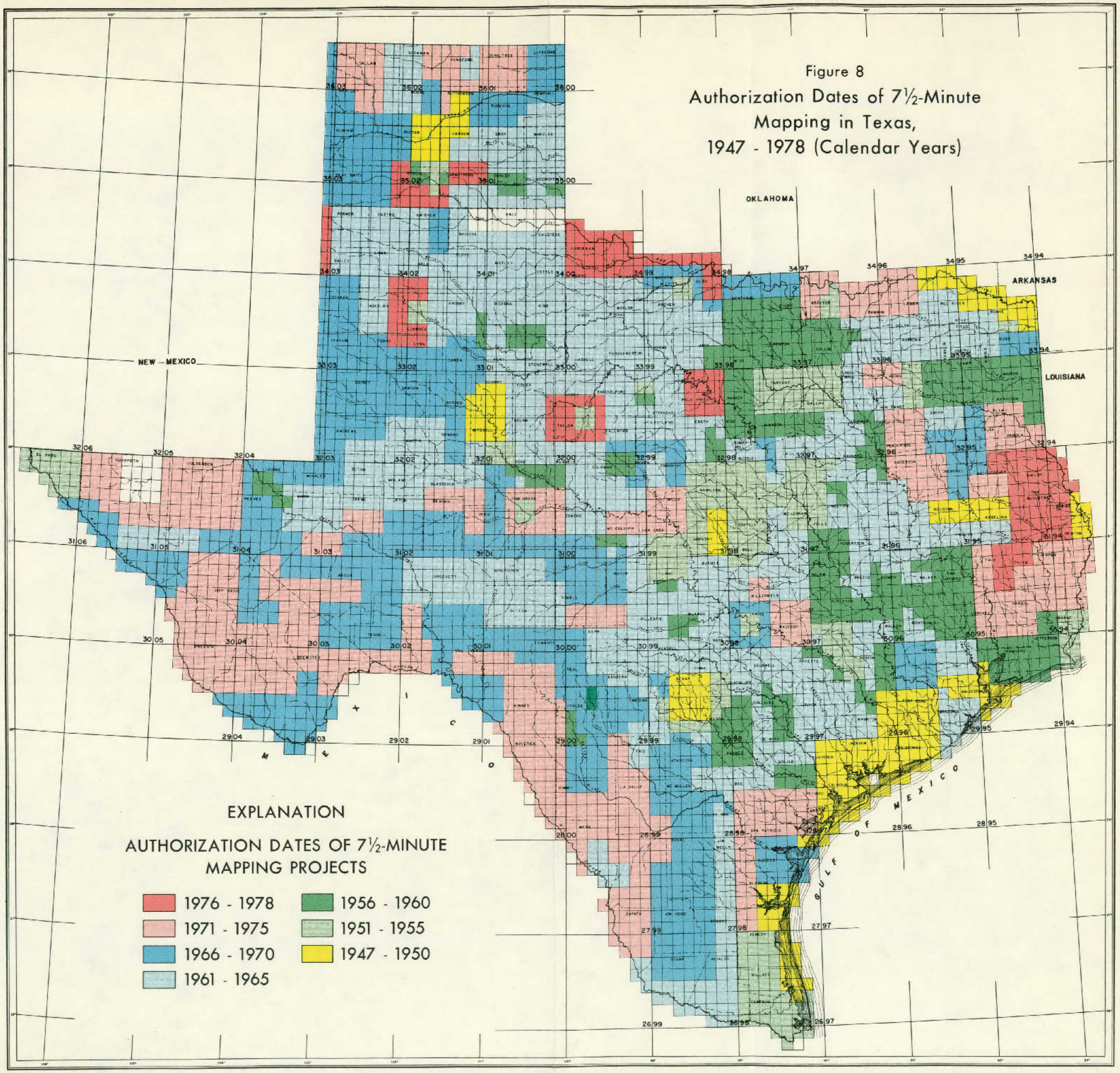
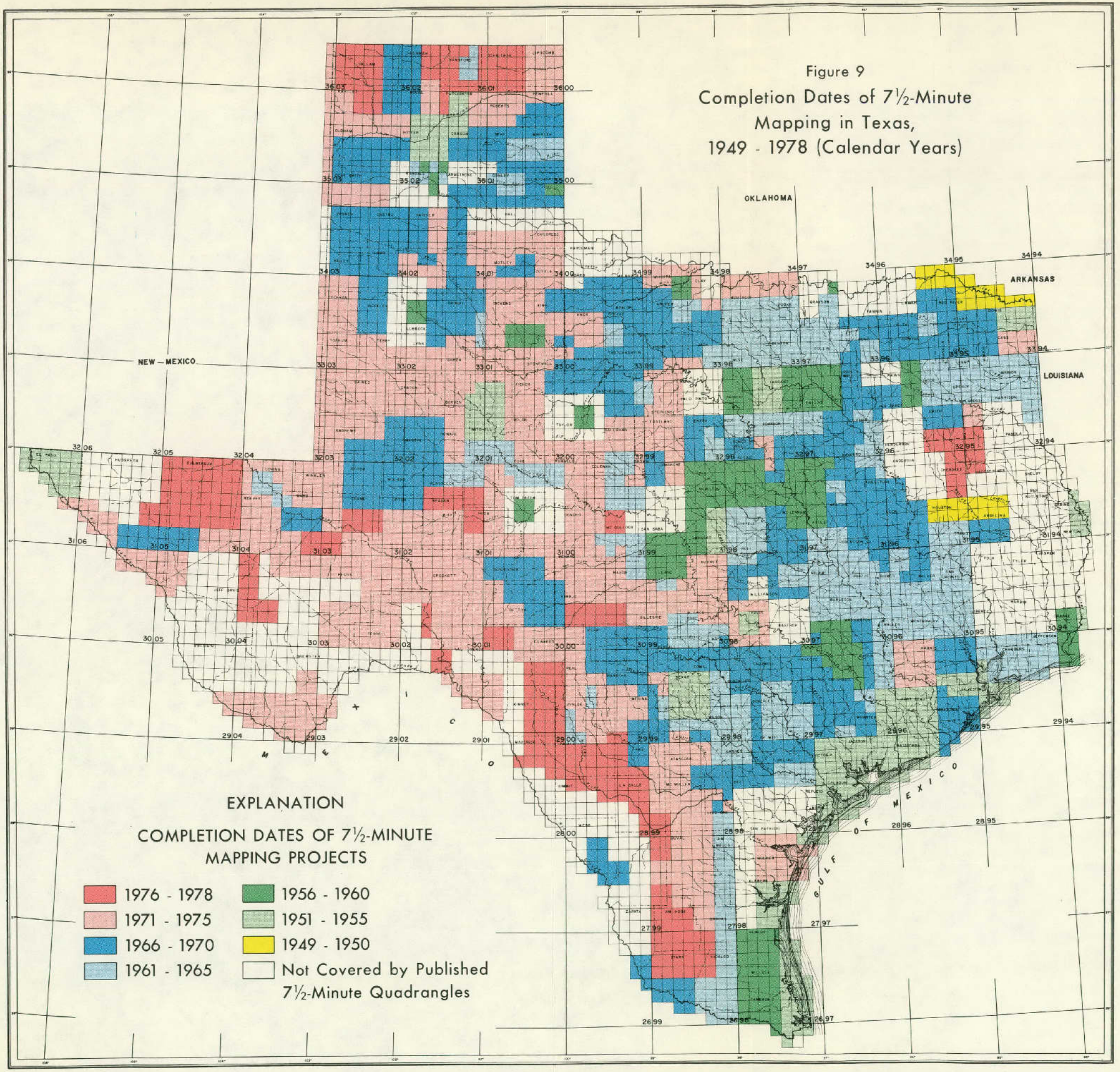


Figure 9

Completion Dates of 7½-Minute Mapping in Texas, 1949 - 1978 (Calendar Years)



The entire area of Texas is also covered by 1:250,000-scale maps published by the U.S. Geological Survey. These maps were originally prepared as military editions by the U.S. Army Map Service (now Defense Mapping Agency) during the 1950's. The U.S. Geological Survey now maintains and updates this series of maps on an 8-year cycle. Generally, the 1:250,000-scale maps cover 1 degree of latitude and 2 degrees of longitude. They are extremely useful in providing comprehensive views of extensive projects or for regional planning purposes.

Also housed by the Map Distribution and Information Center are blue-line prints of intermediate-scale series maps. These maps have been produced by the U.S. Geological Survey in cooperation with the Soil Conservation Service of the U.S. Department of Agriculture. In some areas, these maps have been produced in a county-format series at 1:50,000 and 1:100,000 scales. Some of the intermediate-scale maps are being produced in 30-minute by 1-degree quadrangle format at both the 1:50,000 and 1:100,000 scale. Presently, there are only 24 counties available in the county-format series and there are 11 of the 30-minute by 1-degree quadrangle format maps at a scale of 1:100,000 covering portions of 25 counties.

Another product that is stocked by the Map Distribution and Information Center is the 7½-minute series orthophotoquad. Orthophotoquads are fully horizontally rectified photographic images prepared on a standard 7½-minute quadrangle format base at a scale of 1:24,000. The orthophotoquad is valuable as a map substitute and as a map complement. Orthophotoquads totaling 556 quadrangles covering portions of Texas situated in 59 counties are housed in the map depository.

From time to time it is necessary to completely remap outdated maps. Whenever possible this expensive procedure is avoided by preparing a photo-grammetrically revised map. Such a map simply adds changes that have occurred since the original map was compiled. Most of these changes, such as roads, dams, built-up urban areas, and the like, come about as a result of man's activities. The U.S. Geological Survey attempts to photorevise maps covering Standard Metropolitan Statistical Areas on a 5-year schedule. During 1978, the Department received 93 newly-published photorevised quadrangles as compared to only 65 newly-published 7½-minute quadrangles covering areas not previously mapped in the 7½-minute series.

Advancement is being made in many areas of the United States to begin producing maps in metric units. The U.S. Geological Survey is planning to completely convert to metric map products as soon as possible. The Texas Mapping Advisory Committee has strongly urged that the U.S. Geological Survey delay metric conversion of 7½-minute series maps in Texas until mapping of the State has been completed in the conventional units. That recommendation has been agreed to by the U.S. Geological Survey. Future conversion of the 7½-minute series to metric units will likely involve changing the scale from 1:24,000 to 1:25,000 and possibly changing the format from 7½-minute quadrangles to 7½- by 15-minute series maps. The presently popular contour intervals of 5, 10, 20, 40, and 80 feet will probably be replaced by intervals of 1, 2, 3, 4, 5, 6, 10, 20, 30, 40, 50, 60, and 100 meters.

COMPLETION OF THE PROGRAM

How long will it be until the entire State is covered with modern published maps? That is a question which is difficult to answer.

At the end of 1978, there were 771 unpublished 7½-minute quadrangles. All but 37 of these were authorized and in some stage of the mapping process.

Unfortunately, State funding has become less readily available for allocation to the mapping program. Accordingly, a slowdown in the completion of published maps partly financed by State funds is being experienced.

Because of funding limitations, the San Augustine cooperative mapping project, 21 quadrangles authorized in 1976, was reauthorized last year as an all-federally-funded project. No new authorization of cooperative projects can be foreseen. Funds will be used to advance previously authorized projects to the greatest extent possible. It is likely that additional reauthorization of cooperative projects as all-federally-funded projects may be necessary in order to advance the entire mapping effort in a timely fashion.

The 37 quadrangles remaining to be authorized at the end of 1978 should, it is hoped, be authorized during 1979. Such action will be tempered by possible reauthorizations from the cooperative program. In 1978, new authorizations under the all-federally-funded program, including the San Augustine project reauthorization, totalled only 27 quadrangles.

With even more stringent State funding limitations being a distinct possibility, it is very difficult to project when the last map will be published completing the

initial modern mapping of Texas. The best estimate that can be made at the moment is 1985 or 1986.

Of course, as has been mentioned in this report, maps in most areas must be updated at intervals. It is anticipated that the updating will be able to be accomplished on a more timely basis than the original complete mapping effort. The shift to the use of metric units as remapping is undertaken will require appreciable time, however. It is therefore totally impractical to project a time when Texas might be covered by 1:25,000 scale, metric unit maps.

APPENDICES

APPENDIX A

United States National Map Accuracy Standards

With a view to the utmost economy and expedition in producing maps which fulfill not only the broad needs for standard or principal maps, but also the reasonable particular needs of individual agencies, standards of accuracy for published maps are defined as follows:

1. **Horizontal accuracy.** For maps on publication scales larger than 1:20,000, not more than 10 percent of the points tested shall be in error by more than 1/30 inch, measured on the publication scale; for maps on publication scales of 1:20,000 or smaller, 1/50 inch. These limits of accuracy shall apply in all cases to positions of well-defined points only. Well-defined points are those that are easily visible or recoverable on the ground, such as the following: monuments or markers, such as bench marks, property boundary monuments; intersections of roads, railroads, etc.; corners of large buildings or structures (or center points of small buildings); etc. In general what is well defined will also be determined by what is plottable on the scale of the map within 1/100 inch. Thus while the intersection of two road or property lines meeting at right angles would come within a sensible interpretation, identification of the intersection of such lines meeting at an acute angle would obviously not be practicable within 1/100 inch. Similarly, features not identifiable upon the ground within close limits are not to be considered as test points within the limits quoted, even though their positions may be scaled closely upon the map. In this class would come timber lines, soil boundaries, etc.

2. **Vertical accuracy,** as applied to contour maps on all publication scales, shall be such that not more than 10 percent of the elevations tested shall be in error more than one-half the contour interval. In checking elevations taken from the map, the apparent vertical error may be decreased by assuming a horizontal displacement within the permissible horizontal error for a map of that scale.

3. **The accuracy of any map may be tested** by comparing the positions of points whose locations or elevations are shown upon it with corresponding positions as determined by surveys of a higher accuracy. Tests shall be made by the producing agency, which shall also determine which of its maps are to be tested, and the extent of such testing.

4. **Published maps meeting these accuracy requirements** shall note this fact on their legends, as follows: "This map complies with National Map Accuracy Standards."

5. **Published maps whose errors exceed those aforestated** shall omit from their legends all mention of standard accuracy.

6. **When a published map is a considerable enlargement** of a map drawing (manuscript) or of a published map, that fact shall be stated in the legend. For example, "This map is an enlargement of a 1:20,000-scale map drawing," or "This map is an enlargement of a 1:24,000-scale published map."

7. **To facilitate ready interchange and use of basic information for map construction** among all Federal mapmaking agencies, manuscript maps and published maps, wherever economically feasible and consistent with the uses to which the map is to be put, shall conform to latitude and longitude boundaries, being 15 minutes of latitude and longitude, or 7.5 minutes, or 3-3/4 minutes in size.

Issued June 10, 1941
Revised April 26, 1943
Revised June 17, 1947

U.S. BUREAU OF THE BUDGET

APPENDIX B

Annual State Expenditures for Topographic Mapping in Texas, 1958-78

Fiscal Year*	Expenditure	Fiscal Year*	Expenditure
1958	$ 167,155	1969	440,000
1959	180,845	1970	480,000
1960	200,000	1971	518,000
1961	187,700	1972	372,450
1962	300,000	1973	370,700
1963	300,000	1974	350,000
1964	300,000	1975	350,000
1965	300,000	1976	350,000
1966	295,000	1977	390,000
1967	295,000	1978	190,000
1968	400,000	Total	$6,736,850

*State fiscal year, which extends from September 1 to August 31.

APPENDIX C

Cost of Topographic Mapping for U.S. Geological Survey-Produced Maps in the Rocky Mountain Area*, 1958-78

Fiscal Year**	Cost Per Square Mile	Fiscal Year**	Cost Per Square Mile
1958	$166	1969	164
1959	166	1970	200
1960	176	1971	204
1961	176	1972	206
1962	162	1973	198
1963	160	1974	194
1964	139	1975	197
1965	159	1976	200
1966	151	1977	258
1967	161	1978	314
1968	163		

*The "Rocky Mountain Area" administrative region of the U.S. Geological Survey includes Texas.
**Federal fiscal year, which extends from *October 1* to *September 30*.